3V & 5V
SHIFT-OUT INTELLIHEAD
USER MANUAL

Specification Part Number 99875258-10

APRIL 2014

MAGTEK®
AN ISO 9001 REGISTERED COMPANY
1710 Apollo Court
Seal Beach, CA 90740
Phone: (562) 546-6400
FAX: (562) 546-6301
Technical Support: (651) 415-6800
www.magtek.com

REVISIONS

Rev Number	Date	Notes
1	17 Mar 03	Initial Release
2	13 Jun 03	Front Matter: added ISO line to logo, changed Tech Support phone number.
3	04 Oct 03	Editorial updates to match 99875259-5. Added clarification to handshake sequence. Reduced max operating voltage.
4	4 May 04	Front Matter: Added Frontispiece drawing; Added new Figures 2 and 3. Configurations: Changed part numbers and descriptions of both entries. Removed bulk of spec while referencing ASIC spec.
5	01 Aug 05	Added 21030012 & 21030013 to Sec 1, configuration list and to drawings in Packaging, Wiring, and Mounting.
6	17 Apr 06	Converted to 3V Delta 3-track ASIC. Sec 1, Features: corrected Low voltage operation, Low operating current, and Ultra-low Sleep current. Added drawing, Figure 7, 21030019.
7	30 Aug 06	Added 5V IntelliHead models: 21030021, -22, -27 & -28
8	19 Jan 06	Added reference to low power and 5V-to-3V models: 21030027& 21030028
9	3 Jul 07	Added 21030030; removed 21030019
10	15 Apr 14	Include latest drawings; further clarify meaning of Transition Revision in the Configurations table

TABLE OF CONTENTS

FIGURES & TABLES

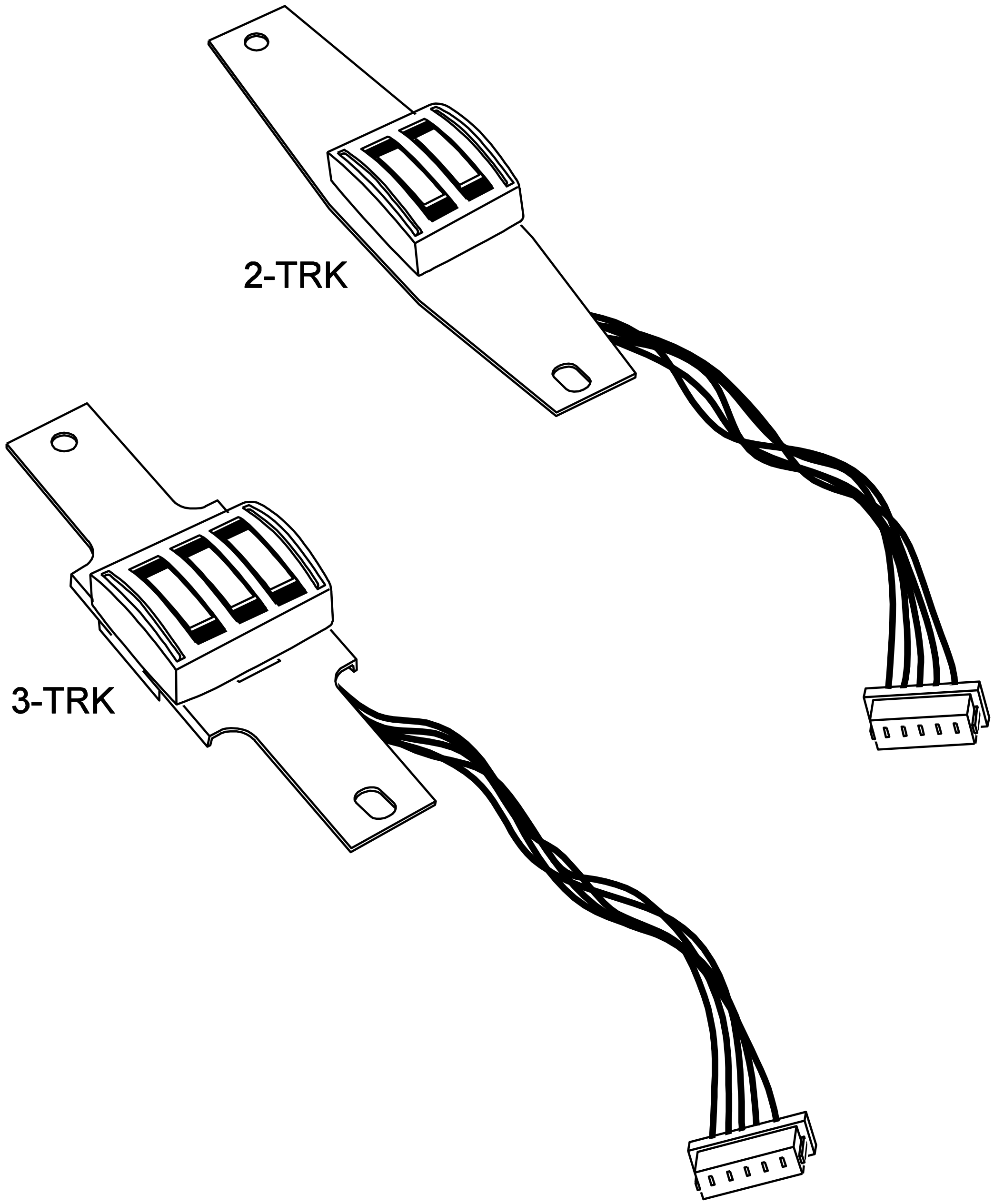


Figure 1. Two- and Three-Track Shift-Out IntelliHead

INTRODUCTION

MagTek's **Shift-Out IntelliHead** consists of a high-performance multi-channel fully integrated magnetic stripe decoder chip *encapsulated within* a low-profile magnetic read-head. This innovative, yet low-cost card reading solution offers many important advantages over the conventional less-integrated approach. The fully integrated Shift-Out IntelliHead is recommended for optimal performance; however, the Triple Track Delta ASIC (Application Specific Integrated Circuit) embedded in MagTek's Shift-Out IntelliHead is available separately in a 14 pin MLF™ (*Micro*LeadFrame™) package for those applications dictating the use of a particular separate magnetic head. Refer to MagTek specification 99875337 (for the 3V part) or 99875336 (for the old 5V unit).

Two other variations on the Shift-Out IntelliHead are also offered:

- The **Low-Power Shift-Out IntelliHead** (21030028 & 21030036) is designed for battery operated devices that need to "wake from swipe." It features a typical quiescent current when armed to accept a swipe of only 1.5 µA. See MagTek specification 99875349 for details.

- The **5V-to-3V Shift-Out IntelliHead** (21030027) is designed to allow the customer to take advantage of some of the cost savings of the newer 3V Delta ASIC in most 5V systems. It features a built-in regulator that accepts a supply voltage of 5V ±5%. See MagTek specification 99875350 for details.

FEATURES

- **Low cost solution for single, dual, or triple track readers** – available in dual and triple-track models

- **Ultra-compact design** – low-profile read head contains all needed circuits. Save PCB space!

- **No external components** – even the decoupling capacitor is integrated. Only 4 signals, VDD, VSS, DATA, and STROBE to connect to your micro-controller for up to 3 tracks

- **Data buffer with Shift-Out** – allows full card data to be locally stored on ASIC. Use a low-cost controller with no interrupts, limited memory, low-speed, low pin-count, etc.

- **High noise immunity** – no analog signals leave the shielded magnetic head! Withstands noisy PC monitors, cell phones, switching power supplies, etc.

- **High performance decoding** – new design reads badly damaged cards; compensates for poor head mounting

- **Low voltage operation** – 2.7 V to 3.6 V (2.8 V to 5.5 V for 5V units)*

- **Low operating current** – less than 1 mA maximum total current at 3.3V (for up to 3 tracks) while card is being swiped (less than 4 mA for 5V units)*

- **Ultra-low Sleep current** – less than 120 µA maximum total current when no card is being swiped

- **AGC (Automatic Gain Control)** – reads cards from 30% - 200% of ISO 7811 amplitude standard
- **Simplified firmware** – Shift-Out format makes it easier to write controller code
- **Wide operational temperature range** – -40° C to +85° C
- **Wide range of card swipe speeds** – from 3 ips to 100 ips (7 cm/s to 250 cm/s)

* See CONFIGURATIONS section below for the definition of 5V unit.

CONFIGURATIONS

The **Transition Revision** column in the table below represents the first revision for which the 3V Delta ASIC (21006540/41) was used instead of the older 5V Delta ASIC. The 5V Delta ASIC (21006529/39 or 21006536/37) is detailed in 99875336 or 99875259.

Part Number	Transition Revision*	Description
21030001	G	IntelliHead 3V, 3 Track, butterfly spring, 125mm wire, 5-pin Molex connector
21030002	F	IntelliHead 3V, 2 Track, butterfly spring, 125mm wire, 5-pin Molex connector
21030012	B	IntelliHead 3V, 3 Track, 43mm spring, 125mm wire, 5-pin Molex connector
21030013	C	IntelliHead 3V, 3 Track, Accordion spring, 125mm wire, 5-pin Molex connector
21030018	2	IntelliHead 3V, 3 Track, 4.05mm beam head, 125mm wire, 5-pin Molex connector
21030021	n/a**	IntelliHead 5V, 3 Track, butterfly spring, 125mm wire, 5-pin Molex connector
21030022	n/a**	IntelliHead 5V, 2 Track, butterfly spring, 125mm wire, 5-pin Molex connector
21030030	A	IntelliHead 3V, 3 Track, 5.08mm beam head, 125mm wire, 5-pin Molex connector

** Not Applicable. This version will always use the 5V Delta ASIC and can be used if the application cannot use the 3V model.

REFERENCE DOCUMENTS

Magnetic Card Reader Design Kit Technical Specification, P/N 99821002
Triple Track ASIC With Shift-Out, 3V, Specifications, P/N 99875337
Triple Track ASIC With Shift-Out, 5V RoHS Compliant, Specifications, P/N 99875336
Triple Track ASIC With Shift-Out, 5V, Specifications, P/N 99875259
Low Power Shift-Out IntelliHead User Manual, P/N 99875349
5V-to-3V Shift-Out IntelliHead User Manual, P/N 99875350

SHIFT-OUT PROTOCOL

Refer to MagTek specification 99875337 (99875336 or 99875259 for 5V units) for details of the Shift-Out Protocol. The additional information below is needed for the firmware designer to assign the memory-tracks of the ASIC (A, B, and C) to the physical magnetic head tracks (1, 2, and 3).

The on-chip memory tracks of the Shift-Out IntelliHead are permanently assigned to particular tracks of the magnetic head via internal wires connecting the head coil wires to particular inputs of the built-in ASIC. Tracks 'A' and 'B' of the internal ASIC correspond to tracks '1/3' and '2' of the reader respectively as it is shown in Figure 2. When the 2-track IntelliHead/spring is mounted as intended, with the centerline of the spring mounting holes running through the center of track 2, it may be used as either a track 1 & 2 reader or a track 2 & 3 reader. Typically the dual-track IntelliHead serves as a track 1 & 2 reader. For the less common track 2 & 3 reader, this IntelliHead/spring assembly may be used in an inverted configuration on the same chassis used by a track 1 & 2 reader. In this case, on-chip memory track 'A' corresponds to physical magnetic stripe track 3 and on-chip memory track 'B' corresponds to physical magnetic stripe track 2. This is important since it affects the arrangement of the data upon extraction from the chip (see below).

Similar concerns apply for the triple-track Shift-Out IntelliHead. As it is oriented in tracks 'A', 'B', and 'C' of the internal ASIC correspond to tracks '1', '2', and '3' of the reader respectively. The IntelliHead may be mounted with the opposite orientation if desired, but firmware must anticipate this re-mapping of ASIC memory tracks to physical magnetic head tracks.

SHIFT-OUT TIMING

Refer to MagTek specification 99875337 (99875336 or 99875259 for 5V units) for details of the Shift-Out Timing. The following exception exists for the IntelliHead in contrast to the ASIC specification given in 99875337.

Trst (Reset) = 10 μs minimum (not shown in timing diagram)
VDD off-time to guarantee a reset for the ASIC/Head unit. This is due to an RC power supply filter inside the head. R = 10Ω ± 5% and C = 0.1 μF + 80%, -20%.

TECHNICAL SPECIFICATIONS

Technical Specifications are as follows:

ELECTRICAL

Electrical Details	See MagTek Specification 99875337 (99875336 or 99875259 for 5V units)
Electrostatic Discharge	± 15kV discharge to head-can with head-can grounded

MECHANICAL

Dimensions	As shown in the Figures at the end of this document
Life	1,000,000 Passes

ENVIRONMENTAL

Operating Environment Temperature Relative Humidity	 -40 °C to +85 °C (-40 °F to +185 °F) 10% to 90% non-condensing
Storage Environment Temperature Relative Humidity	 -40°C to +100 °C (-40 °F to +212 °F) 10% to 90% non-condensing

PACKAGING, WIRING, AND MOUNTING

Packaging and Pin Assignments

Signal and pin assignments for the Shift-Out IntelliHead are shown in Table 1.

Table 1. Signal and Pin Assignments – IntelliHead

Pin Number	Description
1	STROBE
2	DATA
3	VDD
4	GND
5	CASE

Wiring

The Shift-Out IntelliHead Wiring Diagram is shown in Figure 2. The recommended mating connector is **Molex 53048-0510**.

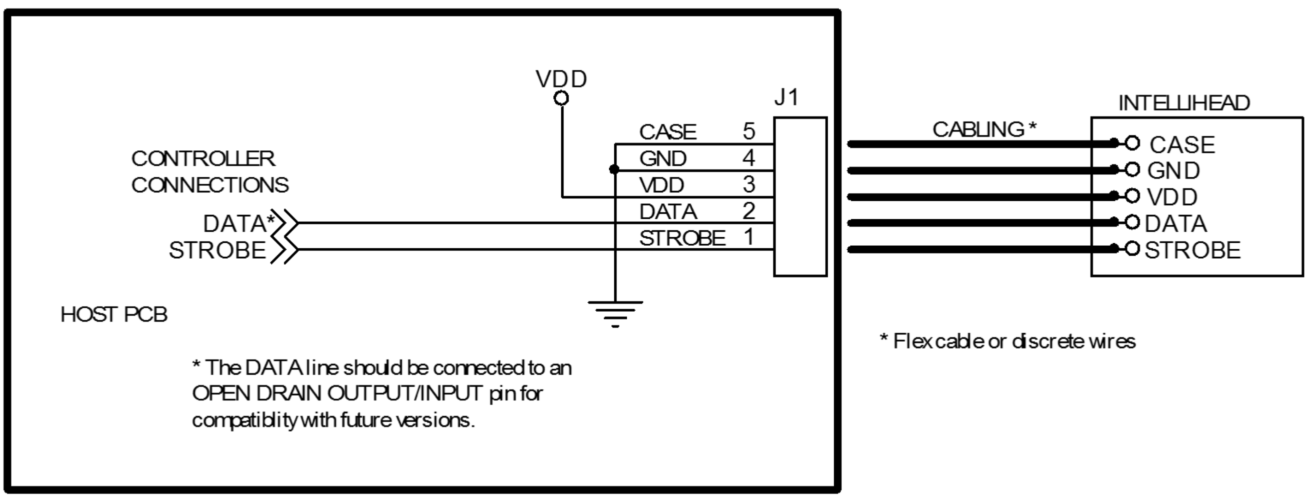


Figure 2. IntelliHead Wiring

Mounting

The Two-track Shift-Out IntelliHead drawing is shown in Figure 4. The Three-track Shift-Out IntelliHead (Butterfly Spring) drawing is shown in Figure 3. The Three-track Shift-Out IntelliHead (43mm Spring) drawing is shown in Figure 5. The Three-track Shift-Out IntelliHead (Accordion Spring) drawing is shown in Figure 6.

Refer to the Reader Design Kit Specification, P/N 99821002, for complete mechanical mounting information.

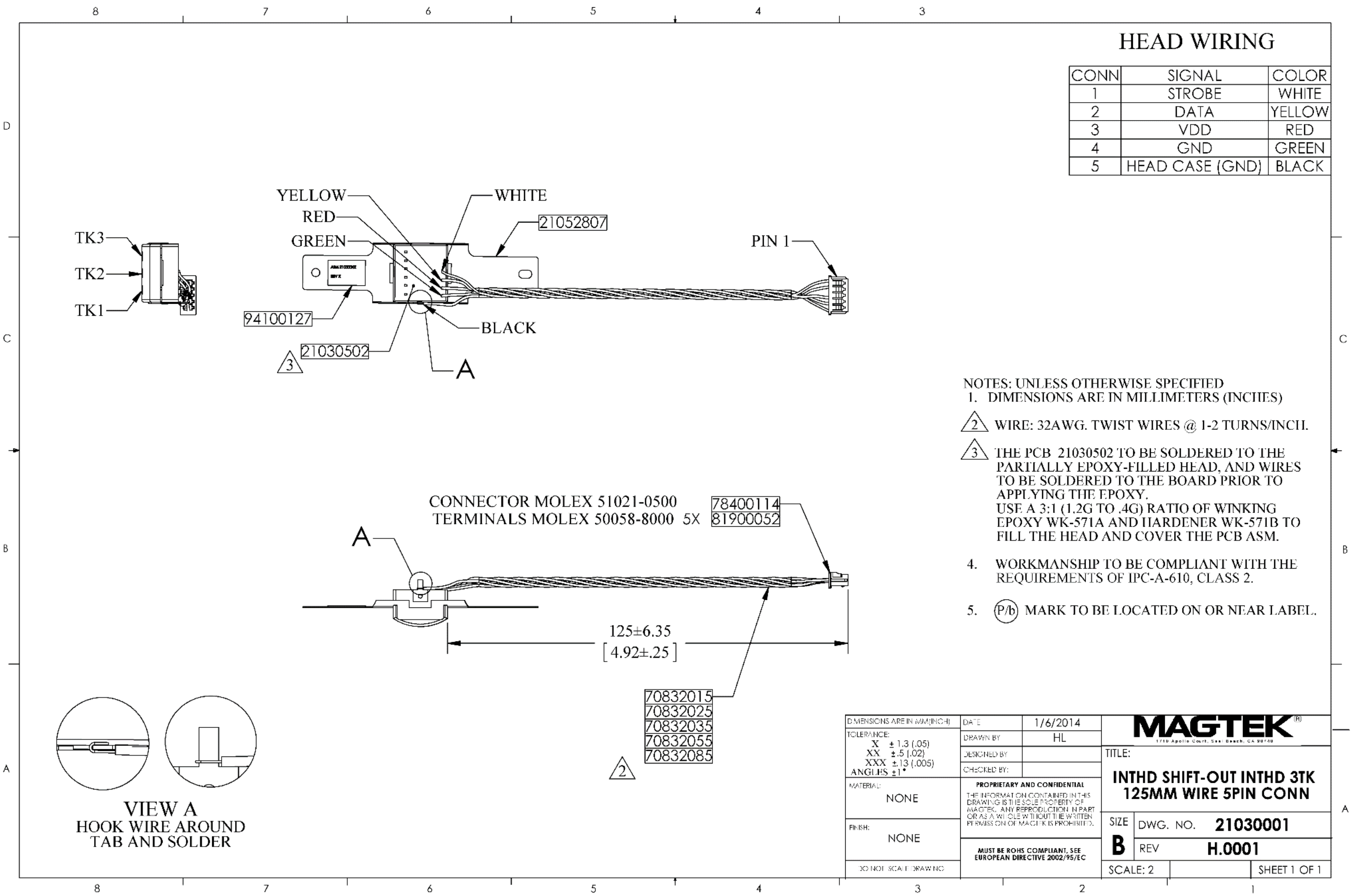
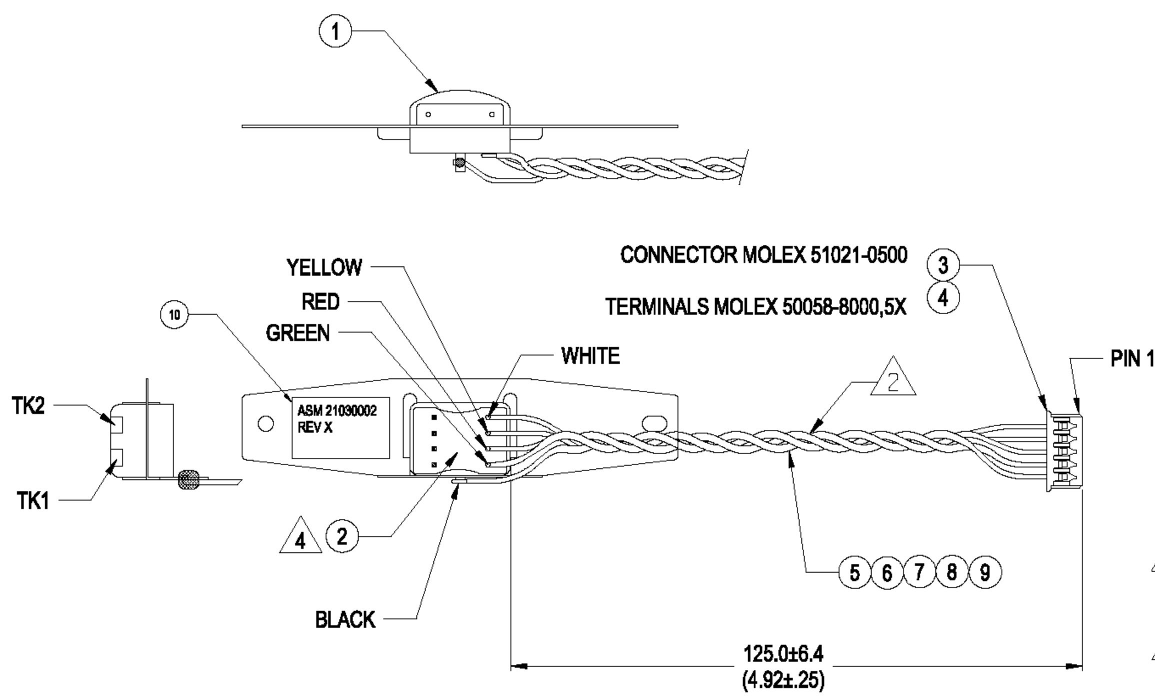


Figure 3. Three-Track 3V Shift-Out IntelliHead, Butterfly Spring

REVISIONS			
REV	DESCRIPTION	CHGD BY	DATE
2	PER ECN 51381,WIRING CHG.	KV	15DEC03
A	PER ECN 51424,PROD REL.	KV	10FEB04
B	PER ECN 51449,LENGTH CHG.	KV	05MAR04
C	PER ECN 51481	HL	31MAR04
D	PER ECN 51516	HL	19APR04
E	PER ECN 52306	HL	18JUL05
F	PER ECN 52639 PCB CHG/RoHS CMPL	HL	14MAR06



HEAD WIRING

CONN	SIGNAL	COLOR
1	STROBE	WHITE
2	DATA	YELLOW
3	VDD	RED
4	GND	GREEN
5	HEAD CASE (GND)	BLACK

NOTES: UNLESS OTHERWISE SPECIFIED
1 DIMENSIONS ARE IN MILLIMETERS (INCHES).
2 WIRE: 32AWG. TWIST WIRES 1-2 TURNS/INCH.
3 DELETE
4 THE PCB (ITEM 2) TO BE SOLDERED TO THE PARTIALLY EPOXY-FILLED HEAD, AND WIRE TO BE SOLDERED ON THE BOARD PRIOR TO APPLYING THE EPOXY. USE A 3:1 (0.75G TO 0.25G) RATIO OF WINKING EPOXY WK-571A AND HARDENER WK-571B TO FILL THE HEAD AND COVER THE PCB ASSEMBLY.
5. WORKMANSHIP TO BE COMPLIANT WITH THE REQUIREMENTS OF IPC-A-610, CLASS 2.
6. (Pb) MARK TO BE LOCATED ON OR NEAR LABEL.
7. MUST BE RoHS COMPLIANT,SEE EUROPEAN DIRECTIVE 2002/95/EC.

TOLERANCES
X ± 1.3 (.05)
XX ± .50 (.02)
XXX ± .13 (.005)
ANGLES ± 1°

MAGTEK® 20725 S. ANNALEE AVENUE CARSON, CA 90746

INTHD SHIFT-OUT INTHD 2TK 125MM WIRE 5PIN CONN

DRAWN BY	KIMVINH	SIZE	DWG NO. 21030002	F.0001	REV
DATE	13 OCT 2003	B	SCALE 2X	SHEET 1 OF 1	
DESIGNER					

Figure 4. Two-Track 3V Shift-Out IntelliHead, Butterfly Spring

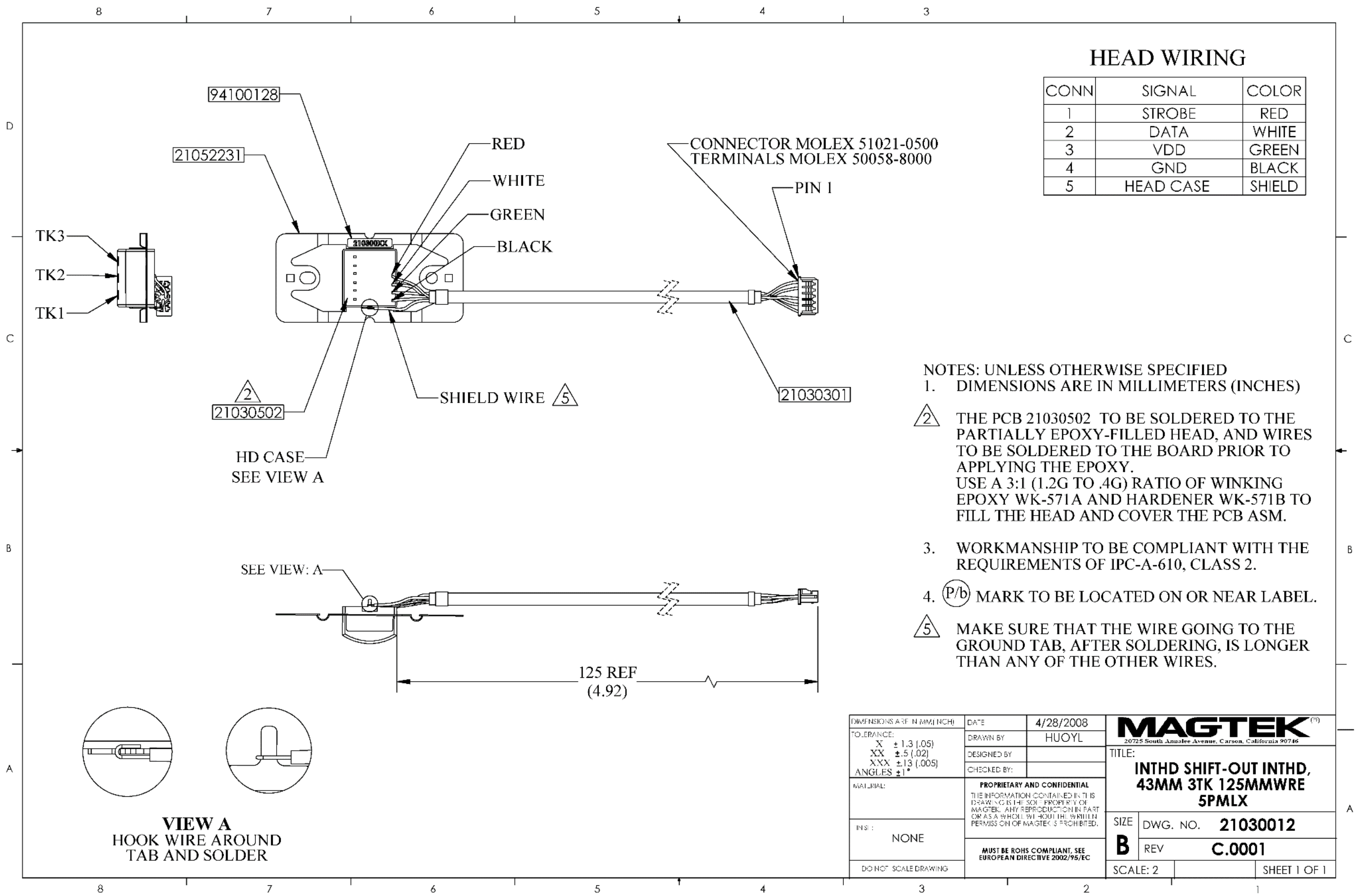


Figure 5. Three-Track 3V Shift-Out IntelliHead, 43mm Spring

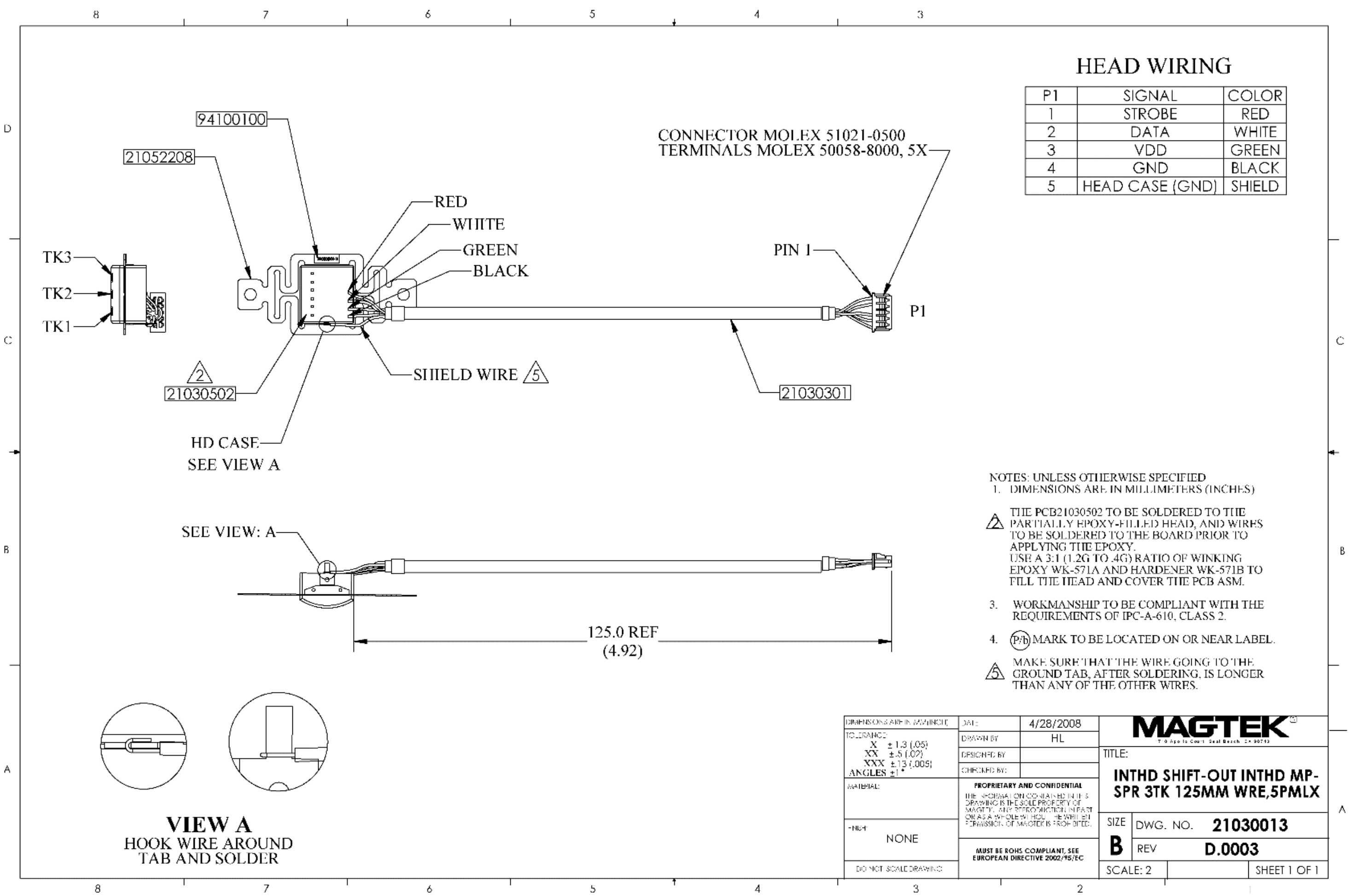


Figure 6. Three-Track 3V Shift-Out IntelliHead, Accordion Spring

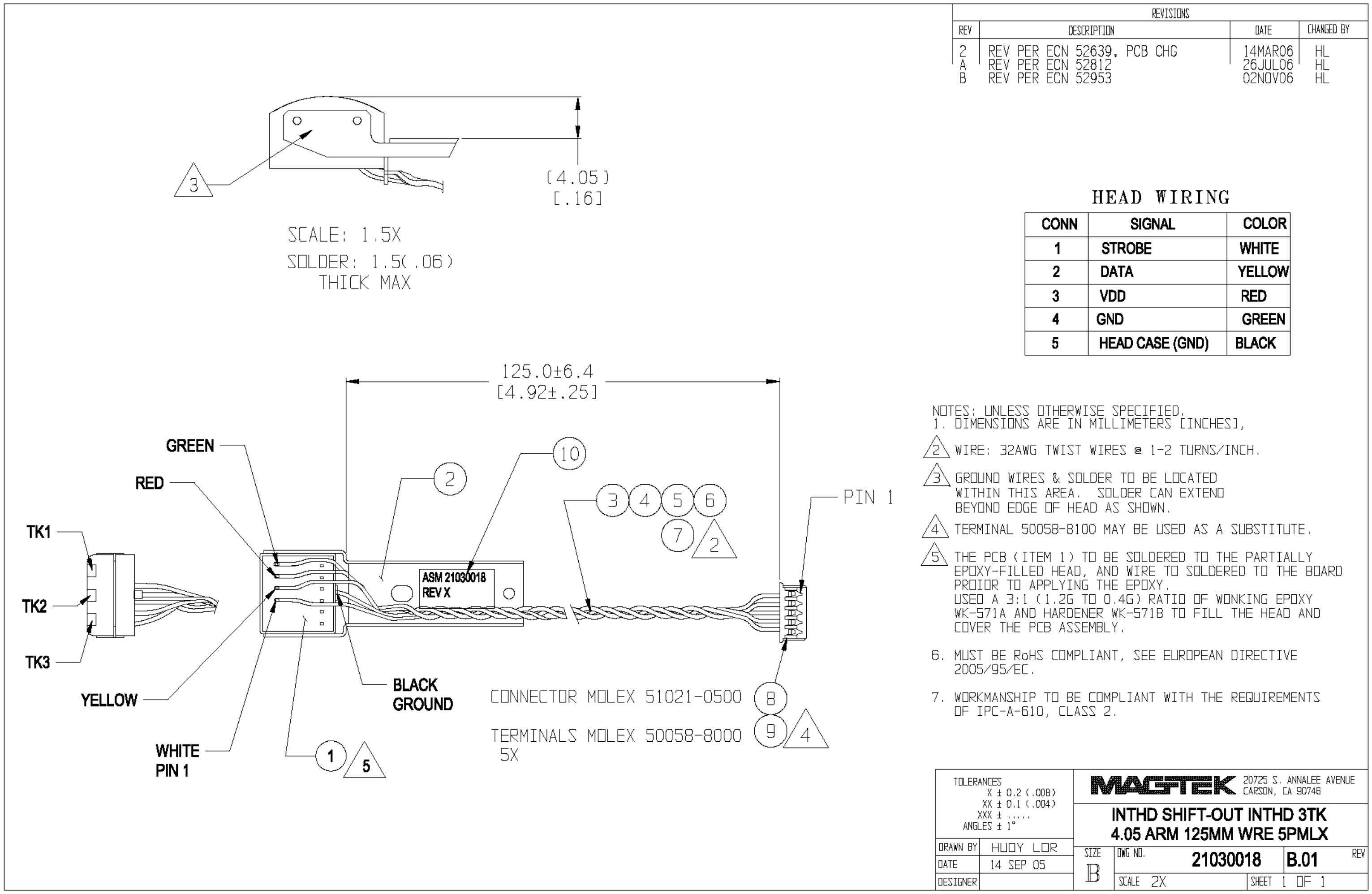


Figure 7. Three-Track 3V Shift-Out IntelliHead, 4.05mm Beam Head

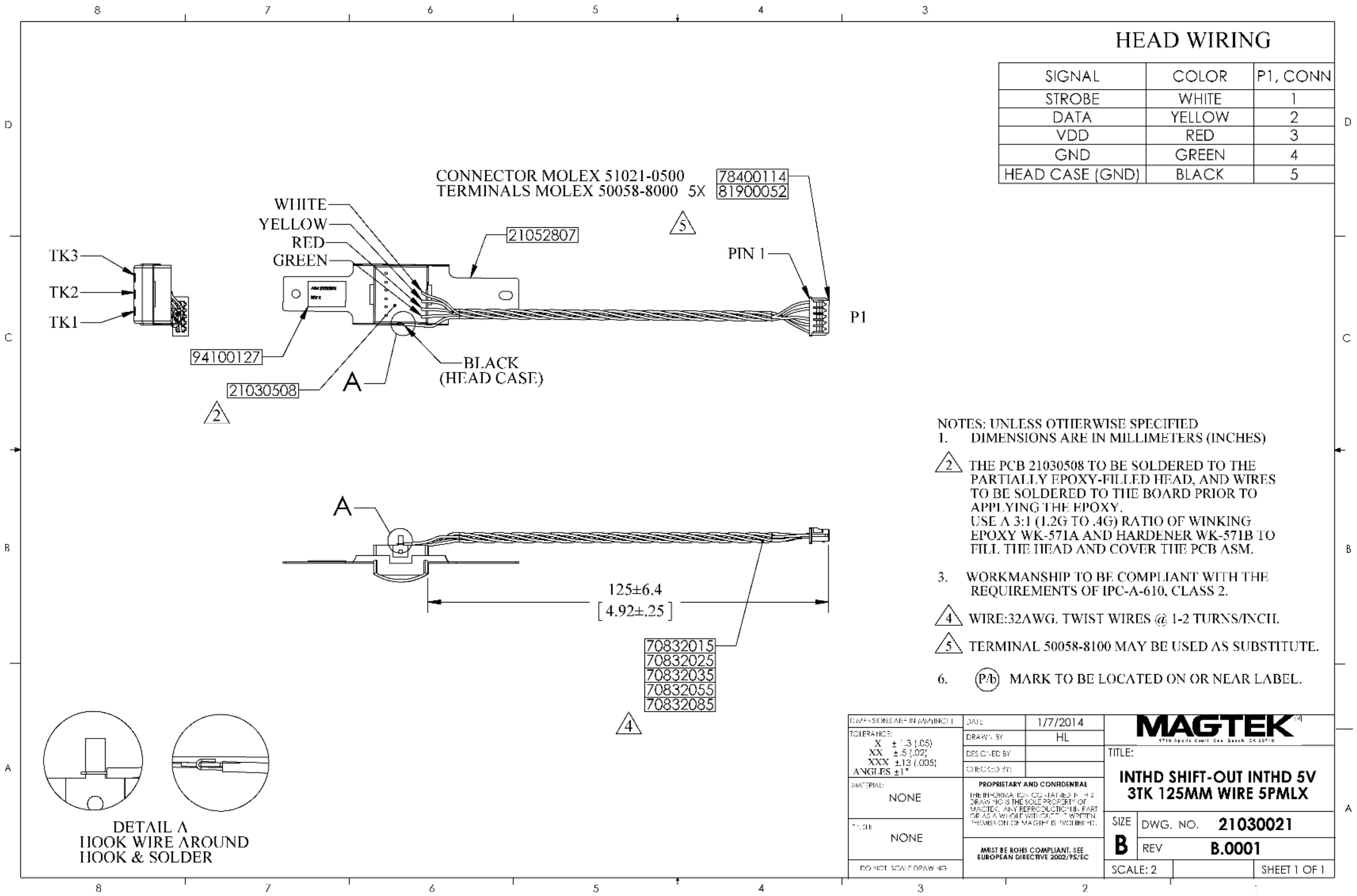


Figure 8. Three-Track 5V Shift-Out IntelliHead, 125mm, Wire 5PMLX, Butterfly Spring

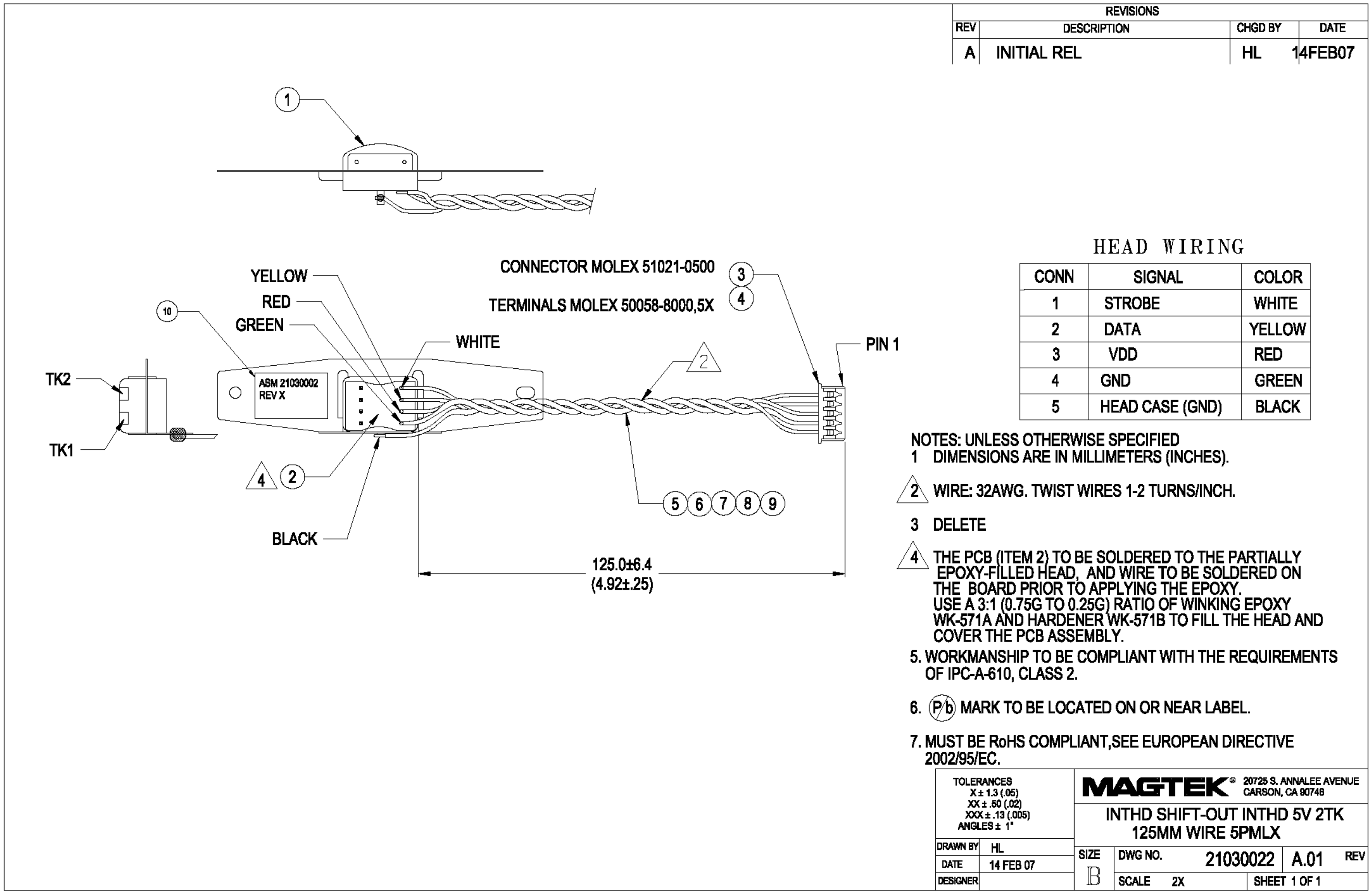


Figure 9. Two-Track 5V Shift-Out IntelliHead, 125mm, Wire 5PMLX, Butterfly Spring

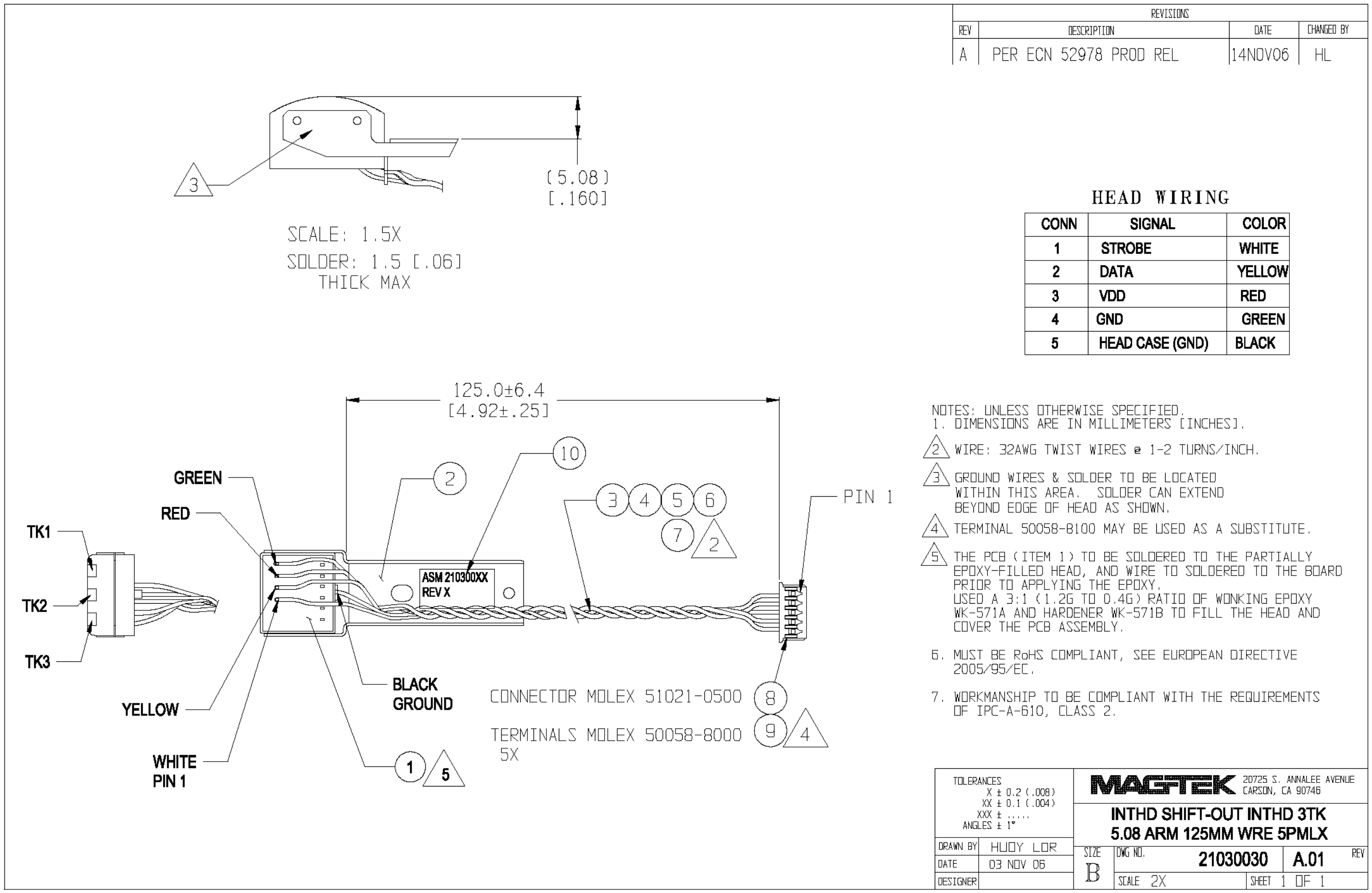


Figure 10. Three-Track 3V Shift-Out IntelliHead, 5.08mm Beam Head